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ABSTRACT

This publication addresses videoconferencing (VC) in technical and further education in Britain. It discusses choosing a system, issues in getting a system up and running, and getting the best out of the system. Chapter 1 defines what VC is, lists ways to use it, describes three basic types of VC (desktop units, roll-abouts, studio/room-sized systems), and describes ways to determine quality. Chapter 2 addresses choosing a system. It considers basic standards, other aspects to consider, meeting the college's needs, organizational issues associated with using standalone VC as opposed to networked systems, and overcoming limitations. It also lists factors to check before buying a system. Chapter 3 focuses on successful VC for further education. It covers preparation before the session, support and training, planning the session, and audiovisual input. Two tables list key tips for achieving a successful session and basic tips when using audiovisual aids. Chapter 4 provides three case studies that offer insight into college practice: Basford Hall College, which uses desktop VC to provide advice and guidance and to offer training programs to the local community; Clarendon College, which offers an interactive television project; and Huddersfield Technical College, which delivers training in the workplace via VC. Each case study offers a summary, background, technical details, uses of the system, and evaluation. Appendixes include a glossary and lists of information sites on the Internet and sources of information on VC systems. (YLB)

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Videoconferencing in FE

Eta de Cicco

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Videoconferencing in FE

Eta de Cicco

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Quality in information and learning technology

The QUILT programme aims to support the development of information and learning technology in further education. The programme includes events, publications, multimedia resources, a consultancy service and development activities. These are focused on staff development and on enabling colleges to develop a response to ILT which encompasses staff, curriculum and resources.

QUILT

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Preface

Why all the interest in videoconferencing? Videoconferencing can support communication between students, tutors and others and can put back some of the humanity removed by impersonal electronic methods. As this publication illustrates, it can be relatively simple to install and use, and the emerging evidence from college practitioners also seems to show that it is effective.

Although it is not yet a technology used universally in further education, colleges and sector organisations in England and Wales which do use it report successes. One college involved in a QUILT development project in 1997 has reported at the interim stage that:

> *for remote learners, desktop videoconferencing has probably been the medium most easily accepted by students so far. [City College, Norwich]*

It can be used to support participation by excluded groups in urban areas and council estates (as with Clarendon and Halton Colleges) or to create virtual classrooms to deliver provision in the Welsh language to rural areas (as with Coleg Menai). Some of these successes are reported in the FEDA publication *Creating Connections*; others have come about from Competitiveness Funding; yet more are likely as a result of the QUILT projects. The case studies in this publication offer insights into college practice. Many other organisations within FE are also taking advantage of this effective means to communicate face-to-face with colleagues over distances. Examples include the Smaller Colleges Federation, National Information and Learning Technology Association (NILTA), the CREDIS (credit framework in Wales) project, the Northern Colleges Consortium, FEDA and the National Council for Educational Technology (NCET).

This general introduction to videoconferencing and its applications intends to be of use to all college staff; the technical information will be of particular interest to IT specialists.

Our thanks go to Eta de Cicco and colleagues at NCET for their work on videoconferencing and on this publication. The NCET and Huddersfield College sites on the Internet are invaluable sources of further information and give details of other FE users, while the FEDA web-site provides details of related work within the QUILT programme. We hope that having read this publication you will be encouraged to meet with other readers in hyperspace.

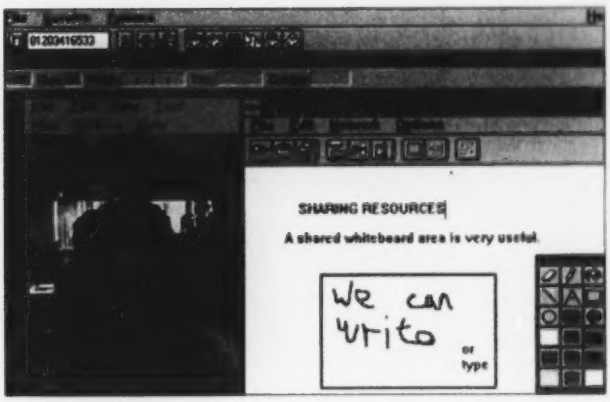
Kevin Donovan
Head of Technology and the Management of Learning, FEDA

1 What is videoconferencing?

Videoconferencing is a form of electronic communication.

It allows people at different remote locations to talk to each other live via electronically linked telephones while also seeing each other on a video screen.

Data is transferred from one place to another via a communications channel. This is the connection through which the information flows between the remote sites. 'Bandwidth' describes how much information can flow through the channel. It is important to get this right for your videoconferencing session to be successful.



Communicating face to face and in writing using PCC videoconferencing software

A great deal of bandwidth is needed to send video data through a communications channel. A television picture in the UK, for example, displays about 25 frames every second (frame rate is the number of still images that are displayed every second). The human eye perceives 25 sequential still pictures as continuous movement. Higher frame rates mean that the video picture is less jerky and more fluid.

The quality of service provided by desktop videoconferencing is limited by the amount of bandwidth available. The greater the bandwidth, the greater the cost. To control costs, the video image is compressed so that it requires less bandwidth. The trade-off is reduced quality: the more compressed the signal, the less it costs to send it to the other site(s) and the more likely that the image quality suffers. The device that performs this compression (and decompression) is called a codec.

Ways to use videoconferencing

There are many ways to make use of a basic videoconferencing system. These include:

- offering classes outside normal college hours
- teaming up with businesses to offer employee training on work premises
- working collaboratively with other education staff and experts on joint projects
- observing and supporting student teachers
- enabling practising teachers to participate in professional development courses remotely
- supporting staff in sharing teaching methods and curriculum material.

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To make more creative uses of videoconferencing, beyond simply speaking to and seeing other participants, you may need additional resources. These may be required if you want to include audio-visual presentations, video transfer, and live collaborative working in your sessions. For example, to project still images or slides you may need an overhead video camera, a high-intensity projector, and the ability to light up the main speaker while dimming the light in the rest of the room. This is where a studio system has advantages.

Videoconferencing can also be used to support students who want to study but cannot attend regular, timed sessions or to allow students to take courses in subjects not on offer in their region. It can also allow students to observe and learn specialist skills delivered by an expert based hundreds or even thousands of miles away.

Videoconferencing can support foreign language learning by allowing students to talk with native speakers. They could also then find out about different cultures and lifestyles. Students could work collaboratively with their regional or international peers on joint assignments, and receive tutorial support and help from staff.

TYPES OF VIDEOCONFERENCING SYSTEM

Videoconferencing can be limited to a simple exchange where the participants only hear and see each other. However, videoconferencing can also allow sound, images, documents and software to be exchanged – anything that can be stored digitally can be sent. This is achieved by participants sharing files or working concurrently on a single document or computer application.

There are three basic types of videoconferencing (VC) system currently available:

- desktop units
- roll-abouts
- studio/room-sized systems.

Desktop videoconferencing

Desktop videoconferencing (DVC) is where participants sit at their desks, in their own offices or lecture rooms, and call up other individuals via their personal computer – very much like using a telephone. Instead of having one monitor per person or site, as the traditional videoconferencing studios have, DVC tends to use a window per person or site displayed on the computer monitor. Most desktop systems use ISDN (Integrated Services Digital Network) technology – digital phone lines. Some can use cable, radio or microwave but these are generally suitable for short distance transmissions only, within a campus via a local or wide area network (LAN or WAN).

The systems come in three basic types:

- those that operate over phone lines such as the digital ISDN or PSTN (Public Services Telephone Network) - analogue phone lines
- those that operate over a LAN such as Ethernet
- dedicated systems that use cables, radio or microwave (as opposed to ISDN) to connect each videoconferencing unit, although ISDN will be needed to transmit outside that network.

Some suppliers can provide a mixed system combining all three of the above. It all depends on what you can afford.

What is ISDN?

Each ISDN phone line consists of 1 x 64Kbps (bits per second – the measure used to define the amount of data that can be transmitted). In the UK, ISDN lines are offered in multiples of two: ISDN2 (2 x 64Kbps), ISDN4 (4 x 64Kbps), ISDN6 (6 x 64Kbps) and so on. ISDN2 is usually the minimum required for a videoconferencing session, although there are systems on the market that can operate via a modem and your normal analogue phone line, and ones that can operate over the Internet. The quality of these is not yet considered good enough to be taken seriously as a teaching and learning tool. However, the pace of technology is such that this situation may change in the near future.

Desktop systems are a good choice where the number of learners at the remote site is less than five. They normally use an ISDN2 (2 x 64Kbps) connection, so audio and video quality is usually poorer than with roll-abouts or room systems. However, there are desktop systems available that can handle connectivity of up to ISDN6 (6 x 64Kbps lines) with additional hardware and/or software.

Roll-about systems

Roll-about systems are complete videoconferencing packages contained in a wheeled cabinet. Designed for small to medium-sized groups, roll-abouts are the most common type of system used in commerce today. Usually one or two monitors sit on top of a cabinet, along with at least one camera, an audio system, a control system and the codec. Roll-abouts can also use ISDN technology.

The audio system consists of an echo canceller, often an audio suppressor unit to handle background noises, microphones, speakers and amplifiers. The control system gives control over the video images, camera orientation, audio levels and other peripherals. The camera can either capture all of the participants or be remotely controlled to select varying views of the room. A graphics or document camera is commonly used to share documents, objects and other graphics. A roll-about is more expensive than a desktop system, but the quality is better.

Room and studio systems

Room and studio systems include all the same equipment found in a roll-about, but instead of living in a cabinet on wheels, they are installed in a permanent or semi-permanent form. It is the most expensive option.

The system, which often has more peripherals than a roll-about, can be kept on shelves hidden away from view. It is more likely to be used for a one-to-many formal interaction situation, such as traditional teaching methods (for example, classroom lecturing) where the lecturer has control. Since the equipment is fixed in one location, usually a purpose-built room or classroom, advanced booking of the system is required, so having spontaneous sessions may be more difficult than with a desktop system.

Room-size videoconferencing usually uses multiple ISDN lines (more than the minimum ISDN2 required for desktop conferencing). It offers higher quality audio and video facilities than DVC and, in some cases, higher than a roll-about provides.

Determining quality

Bandwidth

The quality of a desktop videoconferencing system depends very much on how much information can flow to and from each participant's computer. The transmission of data is the bottleneck of a video conference. There are several means available to transmit the data, the most popular ones being Ethernet, ISDN and, increasingly, Frame Relay and ATM (Asynchronous Transfer Mode) – which is basically very high bandwidth in the region of 45Mb upwards.

Number of participants

The number of participants increases the amount of data that has to be transferred, so more bandwidth will usually be needed.

Video

The quality of video is determined by: screen size; number of frames per second (FPS); the image depth or colours in an image.

Sound

Sound quality is determined by the sample rate, the sample size, and whether it is mono or stereo. A sample rate of 8kHz is what the UK telephone system uses. The *minimum* audio requirement for a H.320 system is 3.3kHz but the higher the sample rate, the better the audio. The sample size refers to the size of the sound file you are sending. The greater the size of the sound file, the more bandwith you will need to achieve the same quality of output. At the moment, this only applies to dedicated systems.

Data de/compression

Data compression techniques help make better use of the available bandwidth.

Additional features

Additional cameras and software allow still images such as pictures, graphs, or drawings to be transmitted. They also allow participants to share applications, for example, Microsoft's Publisher or Excel. To achieve this, you will need ISDN2 as a minimum. However, the more bandwith you have, the quicker the speed of transmission.

2 Choosing a system

What about standards?

When you choose a videoconferencing system, you need to make sure that the software technology on which it is based is not proprietary. Proprietary systems can only communicate with products made by the same manufacturer. International standards organisations were created to establish and oversee standards to deal with the compression, transmission and decompression of data throughout the world. Standards should eventually ensure that systems made by different manufacturers can communicate with one another.

Basic standards

At the moment, if your system is H.320-compatible, for example, you can only transfer video and audio with other H.320-standard systems. However, most videoconferencing systems, including desktop units, have the 'application sharing' facility. This allows a user at one site to start up a software program for it to be viewed and used by users at the remote sites, even if they do not have the software themselves. However, for this to work both videoconferencing units must be using the same videoconferencing software, although a standard (T.120 for desktop units) is still being developed which should allow software created by different manufacturers to share data. At the moment, to guarantee that you can share application data with another system, it must be exactly the same as your own. As much as possible, ensure that any system you buy will be conformed to the T.120 standard.

The basic standards for audio/video are:

- H.324 for POTS (Plain Old Telephone System)
- H.323 for IP (packet switched)
- H.320 for ISDN (circuit switched).

If your system is H.320-compatible, you can also connect several people, who are also on an H.320-compatible system, via a multipoint bridge or unit. (This can also be used to connect people who are all using the same system.) Some multipoint units can only connect ISDN systems; others can deal with higher types of transmission. You can use either a Multipoint Conferencing Unit (MCU), although this is expensive, or hire time on a third party's multipoint facility. Multipoint allows you to transmit continuous audio from several sources, and, with additional equipment, allow four or more participants to view simultaneously (known as continuous presence).

Other aspects to consider

Before deciding on a videoconferencing strategy, you need first to consider what resources your institution already has and what resources can be made available. There are many types of communication lines and services available which provide the channel between videoconferencing sites. These range from a normal analogue phone line to dedicated and switched connections.

With a circuit-switched connection, such as ISDN, the connection, and hence the bandwidth, is maintained between participants throughout a video-conferencing session. Circuit-switched digital lines are similar to standard telephone lines in that they work on a dial-up basis, and use copper cables. Where they are different is that being digital they can support all types of digital signals, including video, audio and data.

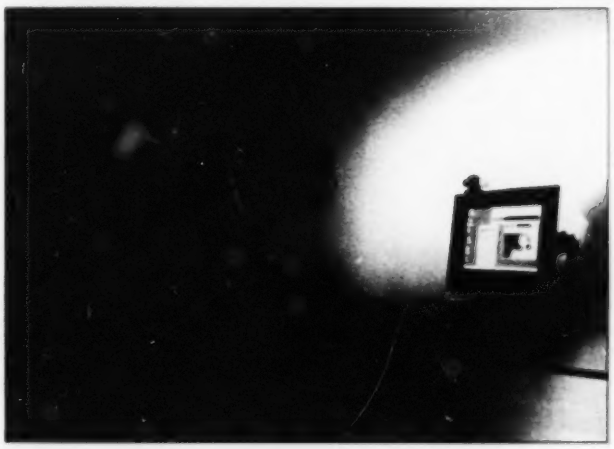
Packet-switched connections, as used on the Ethernet and the Internet, send the data in packages. There is no permanent link between participants, and, more importantly, packages can either arrive late or be lost completely. Techniques do exist to deal with this problem. The type of compression a system uses will depend on the type of connection, whether it is a packet or circuit-switched.

Within your institution, a videoconferencing system might sit as a standalone unit, or use your LAN or WAN to exchange data. Videoconferencing systems most commonly require a minimum of 128Kbps bandwidth. If available, multiple ISDN lines can be dialled to increase transmission rates. The additional lines cost more, but they allow higher video quality. However, you will need additional hardware and software to combine the bandwidth of these multiple lines. Commerce tends to opt for ISDN6 (6 x 64Kbps lines), and some FE colleges are using this also.

Although most videoconferencing occurs over terrestrial lines (those on or under the ground), satellite, microwave and radio transmissions can also be used. Satellites offer the unique ability to transmit to many locations in a cost-effective way. They are sometimes the only alternative in remote areas not covered by terrestrial lines.

MEETING YOUR COLLEGE'S NEEDS

Desktop systems are usually built on an IBM-compatible PC platform, based on a 486 or faster microprocessor (or its equivalent on a Macintosh machine). The codec (the compression device) can be either hardware (usually an expansion board or boards) or software. The higher the specification of machine, the better the quality of the videoconferencing (see Table 1).



The higher the specification of your computer, the better the quality of the videoconferencing

To accommodate the video signals it is usually necessary to connect to an ISDN or other type of digital line. However, new standards are emerging that allow similar capabilities over a regular telephone line, using a modem running at 33.6Kbps. There is also software available, such as CUSeeMe, which operates over the Internet. At the moment, the compression on these systems is such that the resulting video and audio quality is not ideal for many teaching and learning applications.

Some of the desktop systems only run up to ISDN2 but others run up to ISDN6. These latter systems offer better video and audio quality, and faster data and file sharing capabilities. Although, in general, the video and audio quality on desktop systems is not as good as on larger systems, it is improving all the time. If you want to participate in multipoint videoconferencing, linking more than two separate remote sites simultaneously, you will need either to buy additional hardware (known as a multiplex unit) or lease time on a third party's multiplex facilities.

A large monitor and additional microphones and cameras connected to the videoconferencing unit work best for lectures. Roll-abouts and studio systems can usually deal with additional cameras and microphones but not all desktop systems can, so check this out before you buy. Some suppliers offer low-cost, software-only solutions, while others provide an entire solution to all your videoconferencing needs: software, hardware and accessories.

Ideally, desktop videoconferencing systems should provide:

- support for standards – H.320 or H.324 support and a commitment to support T.120 if the system is ISDN-based
- application sharing – where a user at one end can start up a software program for it to be viewed by other remote users, even if they do not have that software on their machines
- whiteboard – a shared 'working' area which all participants can see, and on which all can add text, pictures
- file transfer – the facility to move entire files, such as graphics, text, audio, software and moving pictures such as video, animation, from one connected computer to another; video and animation are large files so will take some time to send unless you have lots of bandwith
- more than one connectivity option – LAN, ISDN2-6 and so on
- multi-platform capability (can operate on PC-compatibles and Apple Macs and compatibles)
- screen snapshots – the ability to freeze the screen by taking a shot of it for immediate or future display
- the ability to allocate bandwidths dynamically, so you can choose to put aside more bandwidth to transmit the video, audio or data.

Table 1 Desktop videoconferencing: minimum technical requirements

Hardware

- A 486 PC or a computer with equivalent processing power – to provide sufficient processing power to operate a DVC program. Most recent DVC software recommends a Pentium or higher. Try and get the fastest processor you can with plenty of computer memory (RAM) and hard disk space.
- A camera – to be connected to the computer, with a second camera if other images also have to be transmitted.
- A codec card for data compression, although software codecs are being developed which use the PC-processor for de/compression (see under 'Software' below).
- A soundcard, a microphone, and speakers for the sound capabilities.
- A connection to some type of communications channel (ISDN, LAN/Ethernet, Internet, ATM).

Software

- An operating system that works with graphics – common platforms are MS-Windows, OS/2, Macintosh, X-Windows.
- Desktop videoconferencing software – there are many software applications available, some of which are not necessarily compatible with each other.
- Software which simulates the codec functions if you are not buying a codec card. If this is the case the performance, but also the cost of the DVC, is reduced.

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Organisational issues

There are separate organisational issues associated with using standalone desktop videoconferencing as opposed to networked systems.

Buying a standalone unit

- Where will you locate the equipment? Will it be in a classroom, library and/or open resources area, or a dedicated room?
- If a dedicated room is used, how will access be managed?
- Will use in a classroom or library/open resources area distract others?
- What about security?

Buying a networked distribution system

- Can your college's existing network handle videoconferencing?
- If it handles videoconferencing, will this swallow up so much bandwidth as to make other uses difficult, if not impossible?
- Can you expand your existing network to handle videoconferencing traffic?
- If you cannot use the current network, will you have to install another dedicated network or have you got a switchboard telephone system installed that can use ISDN and divert your ISDN lines to different points across your institution?

Networked access will allow more users within the institution to gain easier access to videoconferencing, but you may still find that links to remote sites are confined to the type of external connectivity your institution can afford. This could range from a single ISDN2 link to a broadband connection.

Overcoming limitations

If you are new to videoconferencing and expect the same standards of video and audio that we receive from TV broadcasts in the UK, then in the case of most videoconferencing equipment you will be disappointed.

Videoconferencing, particularly desktop videoconferencing, is still a 'young' technology. Because video and audio signals have to be compressed to be transmitted via limited bandwidth, the information is processed by a piece of equipment called the codec (coder-decoder).

Incoming signals are decoded and outgoing signals are encoded by the codec before being sent to or received from the monitor and speakers. This processing can affect picture and sound quality.

One way in which the codec compresses information is to reduce the frame rate (the number of picture images per second). This can make sudden movements appear jerky and the image seem fuzzy. Audio delays can occur, as can audio 'clipping' and echo. Clipping is when the last word or part of a word is lost to the listener, and echo is where you can hear your own voice being fed back to you via the audio system. All of these things can impede your videoconferencing session.

At the moment, unless you use high bandwidths of ISDN6 upwards, there is no way to transmit video and audio without some audio delay. To counteract this delay, encourage those who are speaking to finish their sentences in a single statement and listeners to avoid interrupting. They should use visual cues, such as nodding, instead of verbal ones.

If you are experiencing audio problems, reduce any background noise in the vicinity, try to use headsets and external speakers whenever possible, and invest in echo cancellation and audio suppression systems. Some videoconferencing systems are sold with such systems, but not all. Check this out before you buy.

Table 2 Factors to check before buying a system

- How many users can one individual desktop system accommodate at any one time? One standalone desktop videoconferencing system is best suited to groups of fewer than five, unless additional video cameras and microphones can be plugged in. Roll-abouts and studio/room systems can deal with larger groups.
- What type of audio facility do you need: a telephone only, headset with microphone and speakers, handsfree (no need to hold the telephone handset whilst you speak) or a full-duplex system? A full duplex system allows more than one speaker to talk at the same time with minimal deterioration in sound quality. Can the audio system be used to make a voice-only call? Does it include echo cancellation and audio suppression units to improve audio quality?
- Can the system produce QCIF (176 x 144 pixels) or CIF (352 x 288 pixels) images? (Pixels are the dots that make up the picture on the screen; the greater the number of pixels used to make up the picture, the higher the resolution.) Can you increase the picture size without too much loss of the image quality? CIF offers a higher resolution picture.
- Will the system allow more than two sites to connect concurrently (that is, does it have a multipoint facility)? Can it handle continuous presence where each user can view up to four to five other users on screen? You usually need additional hardware or software to multipoint, which is expensive. Buying time on someone else's system is an alternative option.
- Will the system(s) be linked mainly internally or externally? If all the units are going to be on an internal network, you might be able to achieve higher bandwidth and not be restricted to ISDN desktop systems only.
- How many different sites will you need to communicate with? If external, each site will probably need its own hardware/software installed.
- Will you need to share applications? Application sharing is not yet standard across different manufacturers. If application and document sharing is important to you, make sure the sites you are linking with have the same software.
- Will the system be used with ISDN only? If yes, try to ensure it conforms to the H.320 standards for video, the standards for audio and the emerging T.120 standard for application sharing. Check whether it can deal with bandwidths higher than ISDN2 and what additional costs this increase will incur.

3 Successful videoconferencing for FE

Before the session

When preparing for a two-way videoconferencing session, plan with interaction in mind. A few days beforehand, ensure all the remote site(s) have the necessary materials to participate in the session. Have a back-up plan in case you encounter technical problems. Know who to contact at your location and at the remote site in case of problems. Carry out the communication necessary to prepare for the session prior to the video connection so that you are not wasting online time on these issues.

Most colleges will have a fixed camera. However, there are cameras available that respond to sound, so will automatically focus on whoever is speaking at the time so you don't need to worry about moving it around yourself during the session. Obviously these are more expensive.

With a desktop or roll-about system, the position of the unit is important. If it is placed in the classroom for a small group of students to use, you need to consider what the rest of the students will be doing while the videoconferencing session is live. Will they be accommodated in the same room as the system, or will extra supervision be needed so that they can get on with separate activities?

Videoconferencing should complement other communication, teaching and learning methods. Explain to any new users what they can expect from the session before you begin.

Support and training

When first carrying out videoconferencing sessions you will need technical support on hand. This can be either provided in-house or by a local or regional expert.

As with any new technology, staff training is essential. A minimum of one day's introduction to the system and its features, plus a further half day for live practice is normally required. In-service training for all staff could be included in your college's staff development plans. Videotape sessions whenever possible to use in future training and for evaluation.

Staff need to be trained how to use the system to get the most out of it

Planning your session

A videoconferencing session should be approached in the same way as for any other communication, teaching and learning situation. Think about the participants and be clear about what you want to achieve. Alternate the various methods of delivery and try to limit any lecturing element to less than 50% of the total session. It is difficult for listeners at the remote end of a videoconferencing session to listen to a long monologue.

Sessions are more successful when there is a regular, planned timetable of usage, when participants have been involved in preparing the agenda(s), and when every user at all sites has a chance to use the technology.

Plan the sessions accordingly. Ensure that any subsequent use leads to progression and is not just a repetition of previous work. Well-planned sessions could develop students' IT skills as well as extend their learning in the specific curriculum area involved.

Support active participation by seeking debate and encouraging questions. Try to achieve this interaction within the first few minutes, even if you then intend to proceed to a lecture, for example. This is more likely to motivate your students to listen.

Provide feedback to participants whenever possible. Establish basic rules to counteract the technology's basic audio and video flaws. These could include to:

- signal in some agreed manner their desire to speak, and that they wait their turn
- introduce themselves before they speak
- pronounce each word slowly and clearly
- look in the direction of the camera and not at the monitor
- avoid long monologues
- avoid interrupting the speaker.

It is often useful to break up any lectures with inter-site participant activities, but be clear about your agenda for the session and distribute it to both sites beforehand. Activities might include pre-prepared question and answer sessions, groupwork tasks, guest speaker involvement, debates and quizzes.

Asking a question can be daunting for participants, especially if it means talking to a camera or monitor. Giving eye contact (looking directly at the camera when speaking) and using the participants' names will help to make them feel more at ease.

Encourage the participants to operate the equipment by delegating tasks to a small group during the session. Involve a different group of participants for the next session, so all have a chance to handle the equipment.

Table 3 Preparing for a videoconferencing session

Learning outcomes	**Activities**	**Materials**	**Time**	**Resources**
What do you expect your learners to achieve?	How will you conduct the session?	What materials will you need to prepare?	How long will the session take?	What equipment and material do you need to prepare?
Have specific aims	*Lecture-style, tutorial, hands-on, a mixture of styles*	*Documents, overhead slides, hard copy handouts, electronic files etc*	*Include time for your delivery and for any interaction that might occur*	*Prepare in advance your video clips, documents for the camera, applications etc*

The more sites involved in a session, the more there is to manage. Multipoint videoconferencing, where more than two separate remote sites are linked simultaneously, is often the most challenging. Such sessions are often voice-activated so that the participant who is speaking is the one seen by all the remote sites, including the speaker's own. Looking at your own image and not at your audience while you speak can be a disorientating experience. You need to prepare students for this.

If you are taking part in a long-term project involving different videoconferencing sites, settle the issue of sharing costs in advance.

Table 4 Key tips for achieving a successful session

- **Think about colours and patterns on show**
  Wear plain coloured clothing and avoid patterns which will confuse the camera's focus and result in deterioration of picture. If you can, position a pastel-coloured curtain behind users.
- **Set out the agenda**
  Explain to participants what you expect from the session before you start.
- **Speak in a strong, clear voice**
  There will be a small time delay for audio transmission, so complete all your sentences in one continuous flow, and avoid interrupting another speaker.
- **Move and gesture slowly and smoothly**
  Avoid rapid movements, so that picture quality is not lost in transmission. Avoid pacing up and down. If you do walk about as you lecture, make sure you remain within camera range.
- **Maintain eye contact**
  Relate to participants by looking directly into the video camera, so that those at the remote site(s) feel a part of the session. Occasionally check your image on camera to ensure the remote users can see you clearly.
- **Show interest in all participants**
  Make a point of communicating with remote participants so that they don't feel left out. As there is an audio delay, increase the time you wait for a reply after speaking or asking a question. Videoconferencing is best used as an interactive tool but bear in mind the audio difficulties. Involve other students by repeating every question or comment one of your students makes, so that everyone will hear them.
- **Remain in view of the camera**
  When not using the whiteboard, application sharing facilities or other audio-visual equipment, make sure that participants can see you or another speaker's facial expression. Show group shots where appropriate.
- **Use audio-visual aids**
  Use audio-visual aids such as images, objects, audio or video clips as much as you would in a traditional classroom setting. Prepare for displaying these via a camera in your planning time. Keep lecture time down to around 50% of the total to make room for either audio-visual aids, discussion or hands-on experiences. If the session is more than an hour in length, try to schedule in breaks.

Audio-visual input

It is very distracting to hear your own echo being fed back through the audio system when speaking during a session. If the interference is extreme, it could completely ruin a live session even when the video signal is acceptable. Echo reduction units definitely improve audio transmission. When a desktop system is used to give lectures or to feature an expert guest, the audio signal from the direction of the audience may still be weak. If so, ask the lecturer or guest to repeat any questions asked by a member of the audience before answering it.

Table 5 Basic tips when using audio-visual aids

- Use large, bold text when you are writing on the whiteboard or for any slides.
- Keep the information simple and concise and make bullet points where possible.
- Avoid using a lot of black on a white background – try yellow on blue for a more clear, readable screen.
- Display the text long enough to allow users time to read it.
- Use aids such as cartoons, diagrams, photos, and video clips, to break up text.
- If you are including short video clips, allow for the extra time it takes to transmit the images to remote users; for longer video pieces, send a videotape to the remote site before you go live and remember to ensure you have copyright permission to use it.

Future needs

Desktop videoconferencing is still a relatively new technology. The standards for video, audio and application sharing need to be agreed and widely adopted before desktop systems become more commonplace in education.

There are also other important issues that need to be resolved.

Although the cost of software is falling all the time, at the time of writing UK connectivity costs are still too high for many colleges. ISDN costs need to be reduced further. Until user interfaces are simplified, greater bandwidth provided and more robust audio and systems developed, we will probably not see videoconferencing used in education with the same ease and access as the telephone. However, the case studies that follow illustrate a growing trend in the sector to make use of videoconferencing, and the websites listed in Appendix 1 provide details of other colleges using videoconferencing.

4 Case studies

Basford Hall College

Using teleworking to reach the community

Summary

The new Cornerstone House Centre in Newstead Village will use desktop videoconferencing to provide advice and guidance and to offer training programmes to the local community. It will act as a local Job Centre and a police contact point. Welfare rights information will be available to the people of Newstead via the system, from the Centre of Economic Regeneration based in Warsop Town Hall, 20 miles to the north, thus reducing staff travel costs. The centre chose videoconferencing because it means that discussions with people from the community on welfare rights issues are more personal than via a telephone or audio system.

Background

Basford Hall College is located close to the centre of Nottingham. Its curriculum is predominantly vocational and includes construction, furniture, design, social work, childcare, access, basic education, business studies, IT and computing.

The college introduced the Proshare Desktop Data Videoconferencing system in December 1994, funded through a Greater Nottingham TEC Teleworking project. Part of this project was concerned with investigating the use of an emerging technology for those who wanted to work more flexibly.

Technical details

The system was installed on a Pentium 90 machine with 16Mb RAM and located in a room mainly used by a group of full-time students undertaking a National Vocational Qualification (NVQ) in Teleworking. In 1994, because of a lack of ISDN numbers, the system was underused.

However, the college quickly realised the system could provide a more interactive and persuasive student-centred means of delivery than the larger room-based systems currently in use to deliver learning at a distance.

The Proshare system could be used to support curriculum delivery for assessments, tutorials, seminars and conferences. It did not offer the video or audio quality for sustained classroom delivery, but it had excellent data sharing features, and it was cheaper.

Desktop videoconferencing systems are now installed in a number of local former mining villages and inner city areas throughout Nottingham to support the delivery of training. These systems have been funded by the college, local TECs or Europe.

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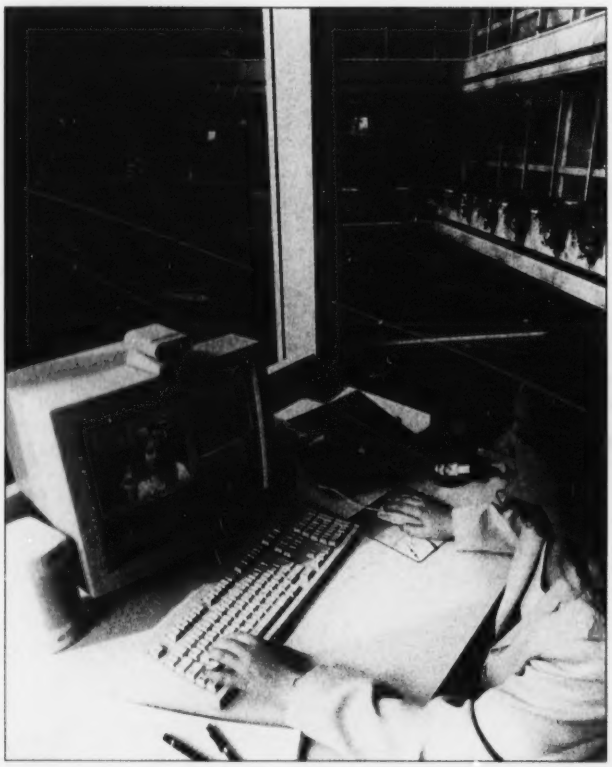
Uses of the system

Support the learning process

Students at the urban and rural centres receive tutorial support from their tutors via videoconferencing. This saves travel time between centres and encourages the use of IT.

Staff and students use the data transfer facility for assessment work during tutorial sessions. This allows the tutor to work on a range of software with an individual or group of students. Access to the Internet can also be made available during these sessions.

Staff are encouraged to use videoconferencing for joint project work between students at outreach centres and those at the main site.



Use videoconferencing to give tutorial support to students at other sites

Support the help desk

Technical support staff at Basford Hall have one Proshare System on the help desk in the College Learning Centre. This allows them to be available from 9am until 8.30pm Monday to Friday and 9am until 12.30pm on Saturdays, to cope with any queries or problems.

Offer student guidance

Student guidance tutors have access to Proshare in the Student Support section of the college. Any visitor to an outreach centre can gain immediate expert advice on any course offered by the college.

Increase IT literacy

The college has introduced desktop videoconferencing into many existing courses across the curriculum to give students experience of a technology that will have an increasing impact on business and commercial environments.

Revitalise the local community

Using European funding from RECHAR II (for areas affected by the declining mining industry) and the Single Regeneration Budget, Basford Hall is working closely with Nottinghamshire Rural Community Council (RCC) to help revitalise former mining village communities. The college intends to connect the RCC with as many of its coalfield offices as possible to allow more staff to adopt flexible working practices.

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Two new systems have already been installed, one in Newstead Village and one in Warsop Town Hall and systems are already in use at the Ollerton and Southwell offices.

This partnership between Basford Hall College and Nottinghamshire RCC offers local villages a variety of advice, guidance and training opportunities supported by desktop videoconferencing. The focal point is the Basford Hall College training office, sponsored by the Intel Corporation. A local computer network allows local businesses and communities to experience videoconferencing and data sharing between computers in a working office environment.

Conclusions

It has taken more than two years for Basford Hall College to realise some of the potential evident in 1994. Introducing new technology is not an easy process. However, the videoconferencing training office has helped to demystify this technology by offering individuals the chance to find out first-hand what it can offer.

This training has led to the development of an expanding social network of users from different organisations. The college aims to extend this network and find new ways to exploit this technology. It also wants to link with other colleges using videoconferencing to share expertise and experiences.

Although desktop videoconferencing systems may not be suitable for projects that demand high quality video and audio, the quality is improving all the time and can vary from vendor to vendor. Videoconferencing will continue to play an important role in support of the training process at Basford Hall College.

Bob Hamp
Project manager

Videoconferencing allows one tutorial group to meet with ...

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Clarendon College

Interactive television project

Summary

A Clarendon teacher takes a class in Office Administration – but not all of her students are in the class with her. Some are at other sites nearer to their home or at sites that offer the creche facilities they need. She achieves this via videoconferencing.

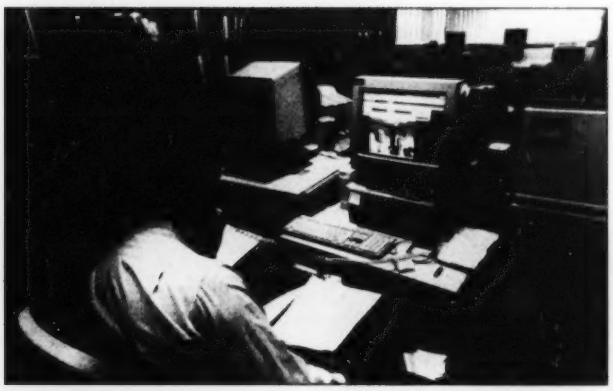
Background

Clarendon College recognises the need to provide education and training opportunities to meet the 'needs of the learner in the 21st century'. The interactive television project is just one initiative to emerge from holding this philosophy. A partnership was formed involving key organisations in the city to build economic and social improvement for the local population.

Project partners

- Clarendon College Nottingham Corporation
- Nottingham City Council
- Greater Nottingham Training Enterprise Council
- Nottingham City Challenge
- Nottingham Trent University (NTU)
- Diamond Cable Communications
- GPT (now Siemens – GEC)

Technical details



... another group at a different site

Clarendon College has benefited from one of the fellowships financed by the Esmee Fairbairn Trust (see *Creating connections*, FEDA, for details). This investment, together with that from the partner organisations, has been significant. It has been enhanced by the donation of time and expertise.

Diamond Cable Communications provided high bandwidth connections around the city of Nottingham using new optic fibre technology. This meant that the full 2Mbps capacity of the codecs (equivalent to 30 phone lines) in the videoconferencing units was available between each of the sites:

- Clarendon College Pelham Avenue
- Clarendon College King Street
- NTU
- ACNA (Afro-Caribbean National Association) Training Project in St. Annes.

The level of technical provision developed so far varies between sites.

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Pelham Avenue, the location for the multi-point control unit (MCU), has a dedicated conferencing studio/classroom well equipped with a video recorder, PC computers and a document camera (for viewing documents closely). The MCU enables more than two sites to conduct a videoconferencing session simultaneously. It not only links up the directly connected sites in the city (at 2Mbps speed), but can also act as a bridge to connect up to 10 other sites, on a dial in or out basis. There are several desk-mounted microphones, and an additional ISDN2 line for videoconferencing on a PC desktop.

The Kings St and ACNA sites have a basic roll-about videoconferencing unit plus a graphics monitor.

The NTU site has a dedicated studio with graphics monitor and independent ISDN6 (equivalent to six phone lines) dial-out capability.

Uses of the systems

Increase access to FE

A key aim of the project is to provide under-represented groups access to FE, hence the siting of equipment in the inner city area of St Annes. Target groups include:

- people with learning difficulties
- women returners
- ethnic groups
- unemployed people who need to update technology skills
- 42% of people in the city areas with no formal qualifications
- 64% of people with adult basic education needs who have never attended classes
- those with a limiting long-term illness.

Prepare staff to use videoconferencing

The interactive TV project provides a means to reach groups who for one reason or another do not wish to study in a college environment. A staff development programme was put in place to train staff in using videoconferencing to deliver teaching and learning via this means. These sessions were recorded so that teachers could evaluate their delivery.

Several pilot programmes were devised to encourage learners at remote centres to participate in courses such as assertiveness and office administration. Other pilots included business studies and communications where students went to remote sites, via videoconferencing, to receive part of their instruction.

Feedback from students and teachers after these sessions informed the technical development of the project. Students enjoy being in control of the equipment themselves, for example, remotely operating cameras, selecting graphics and so on. They have given presentations to the rest of their group and to students in other areas of the country. They are often more at ease with the technology than teachers. From September 1997 the college has delivered the Certificate in Telematics, allowing students to learn how to use the videoconferencing facilities and set up and run live conferencing sessions.

Promote business–education partnerships

The college's new campus, due to open in September 1998, will focus on working in partnership with small and medium-sized enterprises (SMEs). It will have a videoconferencing facility for delivering training to SMEs as well as allowing clients to exploit the use of the facility as a communication tool and to organise videoconferences with their suppliers and customers.

Allow collaborative working abroad

As more colleges and universities around the world have acquired the equipment to carry out videoconferences, Clarendon College's outlook has become more international. Associate degree programmes have been set up with Harold Washington College in Chicago. Staff from the two colleges have been using the videoconferencing facilities to plan the structure and content of the programmes of study. They intend to use videoconferencing for future curriculum delivery.

Clarendon's International Language Centre is to hold regular sessions with a college in Nice, France, as one of its programme modules and hopes to establish links with colleges from other countries whose languages are taught at Clarendon. The Afro-Caribbean centre in St Annes will be given help to establish international connections with relevant groups.

Maria Nicholas

Huddersfield Technical College

Delivering training in the workplace

Summary

A national printing group had a problem with releasing staff for training because of the 24-hour nature of the printing business and the need to have key personnel on hand for any emergencies that might arise. The company agreed to pilot a series of training sessions delivered over an extended lunch break, via videoconferencing, directly into its training room 15 miles away from Huddersfield College in Leeds.

The lecturers delivering the training did not need to leave the college and so could be back at their other duties minutes after delivering the session. The use of a multi-site link allowed members of the company's staff in Luton to receive the training without having to travel to Leeds.

Background

Huddersfield Technical College (HTC) is an FE college catering for a range of local community educational and vocational needs. It has 3,000 full-time and 11,000 part-time students and offers a range of courses for adult learners. It has recently established the Pennine Open Learning College to strengthen this provision. The college sees its videoconferencing-related projects as an extension to normal activities rather than as a means to replace traditional forms of delivery.

Technical details

The college acquired videoconferencing via an initiative it negotiated with Telecom Italia TMI (the Italian equivalent to BT) to install six units in FE colleges across the UK. The purpose of the trial was to explore the uses of videoconferencing equipment for both educational and business use.

The equipment supplied under the trial is the Aethra VTC228 roll-about system. This was installed in a room adjacent to the college's Flexible Learning Centre so that it is accessible to both staff and students. The room can accommodate 30 people but is restricted to about 15 for a videoconferencing session.

In January 1997, the college compiled a directory of FE colleges with videoconferencing equipment, available on the HTC web site http://www.huddcoll.ac.uk. The college also has two ICL VC8000 desktop videoconferencing units and an Aethra desktop video telephone.

Equipment installed

Hardware:

- 486 DX4/100 PC
- Aethra multi-channel codec
- 2 x 29 inch colour monitors
- remote-controlled camera
- desktop microphone
- document camera

Software:

- Windows 3.11
- Aethra Videoconferencing software (H.320 standard)
- application share (T.120 standard)
- multi-conference link

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Uses of the system

Training sessions for the print staff

Six training sessions were organised for the printing company:

- 2 on accounting for non-accountants
- 2 on operating basic Windows 95
- 1 on its grievance procedure
- 1 on its discipline procedure.

The two-hour sessions were adaptations of normal classroom presentations of existing modules. The room-based videoconferencing unit was used to deliver the sessions with a modified desktop unit at the company end.

The video phone was connected to a large television screen and had an additional microphone attached so it could accommodate the six to eight people taking part. The Leeds location was chosen initially so that any teething problems with equipment could be resolved quickly prior to the session, although once the company had installed the ISDN2 connection, the Aethra Mais desktop video phone performed perfectly.

Several test links were established prior to the training to ensure good quality sound, visuals, room layout and lighting and to give the college trainers and the company's human resources administrator chance to get used to the system.

The Windows 95 training consisted of a number of 'how to' exercises. The equipment was set up so that the lecturer could transmit live what he or she was demonstrating on the college computer to the remote site so that trainees could copy the operations on their own PCs. The only adaptations made to the image sent to the remote site was to enlarge certain icons and drop-down menus to make them clearer.

Other uses

The videoconferencing equipment has been used for:

- staff development sessions with colleagues in other colleges
- master classes to local schools
- giving and receiving training
- multi-site conferences (for example, the NILTA Furthering Learning four-way videoconferencing launch)
- contacts between college staff, students and industry
- student-to-student presentations and discussions.

Evaluation

All 15 staff at the print company taking part, in one or all of the sessions, completed an evaluation form and the two trainers each produced an evaluation report. All considered the training a success. Issues raised, which will be incorporated into future sessions, include the need for:

- a paper-based manual for trainees
- more consideration to be given to the positioning of the microphones
- an introductory session to establish names, rules of interaction
- more frequent switching to occur between on-screen material and the trainer.

Company's comments

Positive:

- no travel to receive training
- minimal time lost from primary tasks
- enjoyable and innovative delivery
- useful for other members of staff to receive the same training at other sites
- nothing lost with the trainer not actually present in the room
- delivery on a larger scale would offer significant savings for the company
- possibility of multi-site 'logging on' to receive training sessions
- tailormade training.

Negative:

- sound was occasionally indistinct
- loss of contact with trainer during prolonged Power Point sections
- difficult to remedy problems with trainer not in room (PC training)
- lack of documentation to support training.

Trainers' comments

Positive:

- efficient and convenient trainer-trainee contact time
- structured sessions
- equipment easy to control.

Negative:

- little or no time to make real personal contact
- frustration at not being able to resolve problems quickly (PC training)
- occasional sound problems.

Conclusions

For the company featured in this case study, videoconferencing delivery met the needs of the staff involved. It is becoming another route through which the college can deliver training.

The lecturers involved were able to operate the equipment after a minimum of training. Although a technician did not need to sit in on the sessions, there needs to be one close at hand in case of any technical failures.

Problems experienced due to lack of paper-based support material have been addressed for future sessions. Once this material has been created, it will be made available to other trainers. High quality display materials have been produced so that the session can be structured to suit videoconferencing delivery.

Steve Walmsley

Glossary

ATM (asynchronous transfer mode) – a high-speed packet-switching technology that uses short fixed-length packets called cells to convey video, voice and data; fixed-length packets make processing simpler, quicker and predictable.

Bandwidth – describes how much information can flow through the channel.

Bit rate – the number of bits per second (bps) transmitted; for example, the bit rate of widely-used modems is in the range 300 to 28,800 bits per second, and the bit rate of an ISDN B-channel is 64,000 bits per second (64Kbps).

Circuit-switched connection – the connection between participants is continuous throughout the videoconferencing session.

Codec – a device to compress (and decompress) data; video and audio signals have to be compressed if they are to be transmitted via limited bandwidth.

Compression – a range of techniques used to reduce the amount of space required to store a specific amount of data.

Continuous presence – when four or more participants can view simultaneously.

Data – usually describes items (text, symbols, signals, numbers) in a form which can be processed by a computer.

Ethernet – the most common networking technology used for connecting computers in a local area network, enabling rapid transfer of data (typically up to 10Mbps between machines.

Frame relay – originally conceived as a protocol for use over ISDN interfaces, Frame Relay provides a packet-switching communications capability that can be used across the interface between user devices (for example, routers, computers) and network equipment (for example, switches).

ISDN (Integrated Services Digital Network) technology – digital phone lines.

Multipoint – a device which allows you to transmit continuous audio from several sources.

Packet-switched connection – not a permanent link between participants; data is sent in packages.

Switch – an input device which at any time can be in one of two states: on or off.

Router – a piece of hardware or a software routine that chooses by which routes particular information should travel through a network.

Appendices

Appendix 1: Information sites on the Internet

- NCET's Web Site – A-Z Site Index. See under Desktop Videoconferencing (DVC) and Desktop Videoconferencing: Directory of UK Education Users
  http://www.ncet.org.uk/ss-list.html
- UK Further Education Video Conferencing Sites – a videoconferencing directory of UK further education colleges with videoconferencing facilities
  http://www.huddcoll.ac.uk/whatsnew.html
- Technology Colleges Trust – Videoconferencing Project
  http://www.rmplc.co.uk/eduweb/sites/tctrust/video.html
- JANET (UK) (Joint Academic Network) Videoconferencing Advice
  http://www.tech.ukerna.ac.uk/video/advisory/
- US Directory of videoconferencing
  http://www.kn.pacbell.com/wired/vidconf/directory/directory.html
- BT Initial Teacher Training Communications Technology Initiative – a project looking at videoconferencing to support initial teacher training
  Tel: [01432] 880146
  john.warner@campus.bt.com
  There is a UK Education Video Conference electronic mail list. To join the list send an e-mail message to: maiser@dixonsctc.org.uk and type the following in the body of the message: SUBSCRIBE VIDEOCONF
- Other videoconferencing electronic mail lists – discussions on videoconferencing equipment, uses and standards:
  - ed1vidconf – to subscribe, go to:
    http://www.kn/pacbell.com/wired/vidconf/ed1conf.html
  - rem-conf@es.net
  - videophone@es.net
  - request-videophone@es.net
- Videoconferencing Newsgroup (UseNet) – to share information on all aspects of videoconferencing (you will need access to UseNet groups to look at this Newsgroup):
  comp.dcom.videoconf

Appendix 2: Videoconferencing systems

Web sites

CuSeeMe (Shareware version)
Cornell University's Information Technology organisation (CIT):
http://cu-seeme.cornell.edu
ftp://gated.cornell.edu

CuSeeMe (Enhanced) (Commercial version)
US: White Pine:
http://www.wpine.com/
Intel ProShare System
http://www.intel.com/comm-net/proshare/

ERIS System
http://137.192.243.80/compbase.htm

PCC System (Olivetti UK)
http://www.olivetti.co.uk/

PictureTel System
http://www.picturetel.com/products.htm

Teles System
http://www.teles.de/ukwelcome.html

VTEL System
http://www.vtel.com/products/chrtpcol.html

Other information

CuSeeMe (Enhanced):
White Pine Software, Inc.
1485 Saratoga Avenue
San Jose, CA 95129-4934
Tel: 00 1 408-446-1919, Fax: 00 1 408-446-0666
info@wpine.com

European Headquarters:
About Software Corporation
A subsidiary of White Pine Software, Inc.
9551, route de Saint Laurent du Var
06610 La Gaude
France
Tel: +33 93 24 76 00, Fax: +33 93 24 76 06
euro_info@wpine.com

Intel ProShare System
Intel Corporation (UK)
Wiltshire SN3 1RJ, UK
Tel: +44 [0] 1793 431 155

The Data Base (Nottingham) Ltd
11 Glaisdale Drive East
Bilborough
Nottingham NG8 4GU, UK
Tel: +44 [0] 115 971 2000

PCC System
Olivetti UK Ltd
PO Box 89
86/88 Upper Richmond Rd
London SW15 2UB, UK
Tel:+44 [0] 181 785 6666
Fax: +44 [0] 181 874 3014

PictureTel:
Anywhere Now System (Vivo 324)
http://www.vivo.com/

For details of other PictureTel systems contact:
PictureTel International
258 Bath Road
Slough
Berkshire SL1 4DX
Tel: +44 [0] 1753 723 000

PictureTel UK Information Centre
Tel: +44 [0] 131 451 6896

VTEL Systems
US Headquarters:
VTEL Corporation
108 Wild Basin Road
Austin
Texas 78746

VTEL Europe Ltd
Apex Plaza
Reading RG1 1AX
Tel: +44 [0] 118 956 0915

QUILT

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What issues do you need to consider to get your system up and running?

These are just some of the questions answered in this QUILT publication. It offers useful tips on getting the best out of your system and includes three case studies illustrating imaginative ways in which colleges have put the technology to use.

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